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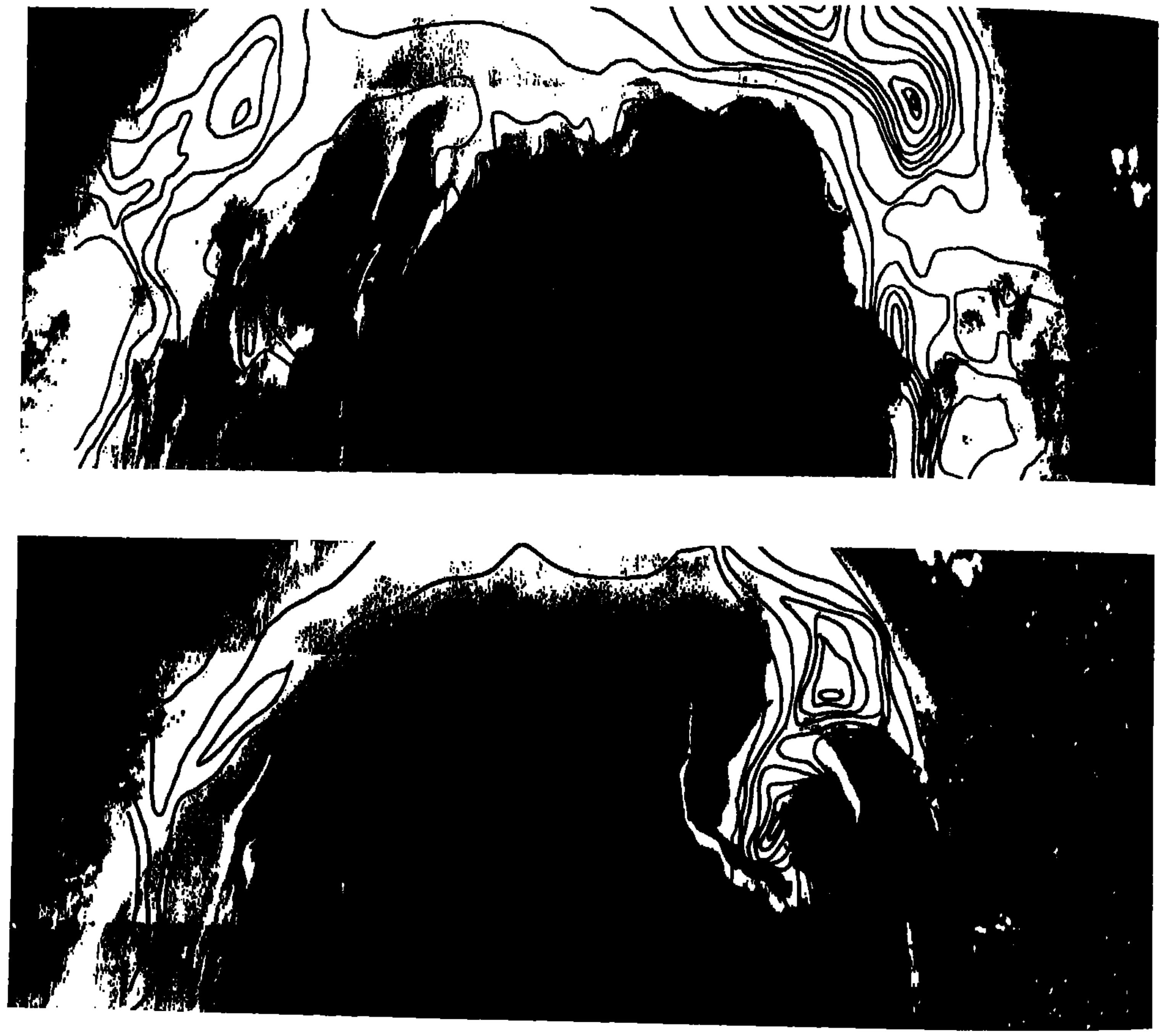

EOS, Transactions, American Geophysical Union Vol. 64, No. 26, Pages 425–440 June 28

Planetology

6510 Atmospheres of planets
SIZE ESTIMATES OF TITAN'S AEROSOLS BASED ON VOYAGER HIGH PHASE ANGLE IMAGES
F. Rages (Mail Stop 245-3, NASA Ames Research Center Moffett Field, CA 94035), J. B. Pollack and P. H. Smith

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J. Geophys. Res., Blue, Paper 3A0798

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News

Cyprus Crustal Study Project

The Cyprus Crustal Study Project is a joint venture of the International Crustal Research Drilling Group (ICRDG) and the Government of Cyprus through its Geological Survey Department. The aim of the project is to carry out a detailed reexamination of the Troodos, Cyprus, ophiolite, using high speed diamond drilling combined with extensive surface geological and geophysical studies. The ICRDG group, comprising about 100 geoscientists from eight countries, includes many participants familiar with ophiolites and with in situ ocean crust through work from *Glomar Challenger*, thus allowing the ophiolite to be viewed from a new perspective.

Studies are being concentrated on a section through the north flank of the ophiolite between the villages of Agrokipia and Palekhori. Research drilling and associated mapping in this segment are aimed at providing a continuous sample through the upper 4 km of the ophiolite and at sampling the stockworks beneath the sulfide deposits located within the extrusive section. The Troodos massive sulfide deposits are considered to be close analogs of the deposited being formed by active hydrothermal circulation on the crest of the East Pacific Rise.

To date, the upper part of the extrusive section has been mapped in detail in the Peristerona and Akaki canyons and a section through the uppermost 485 m of the extrusives recovered by drilling. It is planned that the lower part of the extrusives and the upper part of the sheeted complex will be sampled by drilling this fall. The stockwork zones beneath the Agrokipia A and B ore deposits in the upper part of the extrusive section have also been drilled to depths of 225 and 690 m, respectively.

Core recovery in both the lavas and the ancient hydrothermal systems, at about 90%, is excellent in spite of difficult drilling conditions, such as that represented by alternations of jasper and altered volcanics with claylike consistency. Preliminary studies of the core have provided much new information on the tectonic setting, alteration conditions, and history of seafloor hydrothermal systems. A first report on the results of drilling in the paleo-hydrothermal system is in preparation.

In addition, an 1850-m-deep section from the base of the sheeted complex through a series of gabbros, some showing cumulate textures, to a series of ultramafic cumulates has been drilled with a 99.7% recovery rate. It is planned to extend this hole to about 2000 m this fall. Comprehensive geophysical logging of these and other holes is scheduled.

An important result of the field studies is that the primary geochemistry of the Troodos extrusives is now clearly established. Analyses of fresh volcanic glass, which occurs widely in the extrusive sequence, indicate that two distinct suites are present, and the lava compositions suggest that the ophiolite was formed in a supra-subduction zone environment.

It has been agreed by ICRDG that access to Cyprus Crustal Study Project core will be limited to present participants for a period of 1 year after completion of the drilling.

Major participants in ICRDG are the Cyprus Geological Survey Department; the Faculty of Earth Sciences, King Abdul Aziz University, Jeddah, Saudi Arabia; and university- and government-based groups in Canada, the United States, Federal Republic of Germany, United Kingdom, France, Denmark, and Iceland.

Further information may be obtained from Paul T. Robinson, Project Director, Centre for Marine Geology, Dalhousie University, Halifax, Nova Scotia, Canada B3H 3J5.

This news item was contributed by James M. Hall, Department of Geology, Dalhousie University, Halifax, N.S., Canada.

Merger at MIT

On July 1, the Department of Earth and Planetary Sciences and the Department of Meteorology and Physical Oceanography at the Massachusetts Institute of Technology (MIT) merged to form the Department of Earth, Atmospheric, and Planetary Sciences. This new department will deal with research in climatology, geochemistry, geology, geophysics, meteorology, oceanography, and planetary science. W. F. Brace, former chairman of the Department of Earth and Planetary Sciences, will head the new department.

The new department contains a Center for Meteorology and Physical Oceanography, which will coordinate all efforts in these closely related areas. In addition, the center will serve as a focus for MIT's participation in the physical oceanography portion of the Joint Program in Oceanography with the Woods Hole Oceanographic Institution. The director of the new center is Peter H. Stone, former head of the Department of Meteorology and Physical Oceanography.

With approximately 40 faculty members, 180 graduate students, and 45 undergraduates, the new department aims not only to reduce the potential for duplication under the old organizational scheme but also to promote new, interdisciplinary approaches to research and education involving important environmental problems. MIT officials also feel that the new and larger unit will facilitate administrative, financial, and teaching support for the fields involved.

Senior Scientists

A small task force of volunteer senior scientists and engineers was organized recently under the aegis of the American Association of Retired Persons (AARP) "to utilize its collective talents for the betterment of society and to provide opportunities for individual personal accomplishment and enrichment." Among the projects under consideration are assisting the Washington, D.C., school system to improve its science and mathematics instruction and assessing the impact of technology on older persons.

One of the task force's first projects is to develop a roster of retired scientists and engineers in the Washington, D.C., metropolitan area to garner volunteer talent for future projects. If you would like to be included in a mail survey to determine your interests in volunteer opportunities, send your name, address, and telephone number to Barbara Herzog, AARP, 1909 K Street, N.W., Washington, DC 20049.

Geophysical Events

This is a summary of *SEAN Bulletin*, 8(5), May 31, 1983, a publication of the Smithsonian Institution. The complete bulletin is available in the microfiche edition of *Eos* as a microfiche supplement or as a paper reprint. Subscriptions to *SEAN Bulletin* are also available. For the microfiche, order document E83-006 at $2.50 from AGU Fulfillment, 2000 Florida Avenue, N.W., Washington, DC 20009. For reprints, order *SEAN Bulletin* (give volume and issue numbers and issue date) through AGU Separates; $3.50 for one copy of each issue number for those who do not have a deposit account; $2 for those who do; additional copies of each issue number are $1.00. For a subscription, order *SEAN Bulletin* from AGU Fulfillment. The price is $18.00 for 12 monthly issues mailed to a United States address; $28.00 (U.S.) if mailed elsewhere. Order must be prepaid.

Volcanic Events

Bezymianny (Kamchatka): Ash ejection; pyroclastic flow; lava extrusion.
Kliuchevskoi (Kamchatka): Numerous flank lava flows; weak summit explosions.
Veniaminof (Alaska): Strombolian activity and lava flow.
Grimsvötn (Iceland): Subglacial eruption.
Mt. St. Helens (Washington): Lava dome growth continues.
Etna (Italy): Lava production slows; lava partially diverted; central crater explosions continue; self-potential data.
Mauna Loa (Hawaii): Seismicity and summit caldera deformation increase.
Kilauea (Hawaii): Incandescent vents, harmonic tremor, and dilation across fissure system continue.
El Chichón (Mexico): Aerosol cloud remains strong.
Momotombo (Nicaragua): Fumarole chemistry changes and temperature drops after tremor ends.
Manam (Bismarck Sea): Seismicity, ash emission, incandescence intensify.
Langila (New Britain): Moderate vulcanian activity, one plume to 7 km.
Ulawun (New Britain): Variable seismicity, tremor episode.
Bagana (Solomon Islands): Increased vapor emission; sluggish lava flow.
Sakurajima (Japan): Explosions and large plumes; windshields broken.
Kusatsu-Shirane (Japan): March 9 activity was only seismic.
Ngauruhoe (New Zealand): Earthquake swarms.
Ruapehu (New Zealand): Decreased seismicity; lake temperature lower.

Bezymianny Volcano, Kamchatka Peninsula, USSR (56°07°N, 160°72°E). Bezymianny began to erupt May 22, without premonitory seismicity. Ash was ejected to 5–6 km height and covered the E foot of the volcano. The total area of the ash deposit was about 1500 km². Strong explosions destroyed part of the Novy (new) lava dome (see below) and a 4–5 km long pyroclastic flow was noted at its E base. Andesitic lava was extruded from the dome's summit. Since the beginning of the eruption, the volcano has remained cloud covered, making observations difficult.

Imagery returned June 1 by the NOAA 7 polar orbiting satellite, showing a dark band extending about 250 km to the ESE from the vicinity of Bezymianny above a layer of heavy weather clouds. Because of the clouds, it was not possible to locate the dark band's origin more closely than about 56°N, 160°E, or to determine if the volcano was feeding the dark band at that time. Continued poor weather has prevented additional satellite observations of eruption plumes from the volcano.

Information contact: G. Ye. Bogoyavlenskaya, Institute of Volcanology, Piip Avenue 9, Petropavlovsk, Kamchatskii 683006 USSR; Michael Matson, Land Sciences Branch, NOAA/NESDIS, Room 307, Suitland Professional Center, Washington, DC 20233.

Veniaminof Volcano, Alaska Peninsula, USA (56°17°N, 159°38°W). All times are local (=GMT − 9 hours). Pilots began to report eruption clouds from Veniaminof late June 4, noting that plumes containing some ash rose to about 4.5 km altitude. Residents of Perryville (population 100, about 25 km S of the volcano) saw incandescence and dark skies on June 7 at about 0130. Later that day, U.S. Geological Survey personnel flew over Veniaminof. In the S part of the 10-km-diameter ice-filled caldera, strombolian activity was occurring from two vents on a cone that rises about 300 m above the ice and had previously been the site of fumarolic activity. Cherry-red molten material was ejected several times per minute to roughly 30–60 m height. The tephra rich, but above that height the plume was wispy and light gray. About 30 km² of ice, chiefly to the S and SW, was coated with a very thin layer of ash. In the ice just SE of the cone, a prominent set of ring fractures defined a circular depression, produced by melting, that was estimated to be about ½ km in diameter and no more than 20 m deep.

By the next USGS overflight, at 1500 on June 9, strombolian activity was more vigorous, and lava was flowing down the S side of the cone. Bombs and scoria were ejected every 3–5 s to about 2100 m altitude, about 250 m above the summit of the cone. Tephra had begun to fill the cone's crater, and an increasing number of bombs were falling on its flanks. Lava flowed from the summit down the steeply sloping S side of the cone onto the ice field where a large E-W trending dumbbell-shaped depression had formed. Lava flowed into the W part of the dumbbell and sank into the ice, from which billowing clouds of steam were rising. The base of the lava flow was roughly 100 m in diameter. Open water was present in the narrow area between the two parts of the dumbbell, and the E part was characterized by an unusual fracture pattern. The E part of this feature closely approached, but did not touch, the depression in the ice observed 2 days earlier (see above). The timing of the beginning of lava flow activity was uncertain, but a pilot who flew past the volcano at 1330 on June 8 saw no steam clouds, so lava probably had not begun to flow onto the ice by then.

A short-period seismic instrument located at Ivanof Bay, about 30 km from the volcano, was operating in its standard event-triggered mode until it was reset to record continuously on June 8. Between June 8 and 10, it recorded nearly continuous low-amplitude tremor, with occasional larger discrete bursts that reached (preliminary) magnitudes of 1–2.

No unusual discharge from streams draining the caldera has been observed. An eruption from Veniaminof was last reported in 1944.

Information contacts: Thomas Miller, U.S. Geological Survey, 1209 Orca St., Anchorage, AK 99501 USA; Stephen McNutt, Lamont-Doherty Geological Observatory, Palisades, NY 10964 USA.

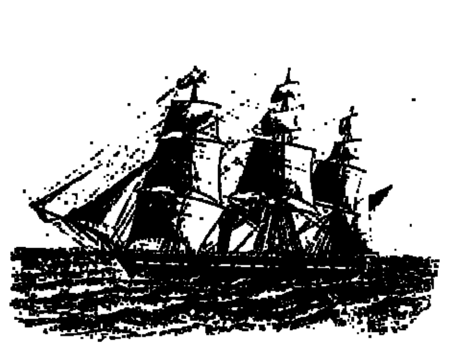
Grimsvötn Caldera, S. Iceland (64°42'S, 17°33'W). All times are GMT. The following report is from Karl Grönvold, Páll Einarsson, and Helgi Björnsson. "A subglacial volcanic eruption started in Grímsvötn below the western part of the ice cap Vatnajökull on May 28 or 29. The central part of the Grímsvötn area is a caldera of about 35 km². This is one of the most active volcanic and geothermal areas in Iceland.

"Melting of ice due to intense geothermal activity and continuous inflow of ice causes a gradual buildup of melt water below the 200-m-thick floating ice shelf in the caldera. This buildup culminates in a jökulhlaup (glacier burst) when the level of the lake reaches a certain threshold value. The water drains in a catastrophic flood beneath the ice, 50–60 km into the rivers on the sandurplain Skeidarársandur south of the ice cap. The jökulhlaups last about 3 weeks and occur about once to twice every decade, the last one in January–February 1982.

"The last definite volcanic eruption in the caldera was in 1934, but small eruptions may have occurred since without being noticed due to the remoteness of the area. In most

News (cont. on p. 444)

The Oceanography Report



H.M.S. Challenger preparing to sound, 1872

The Oceanography Report

The focal point for physical, chemical, geological, and biological oceanographers.

Associate Editor: Arnold L. Gordon, Lamont-Doherty Geological Observatory, Palisades, New York, 10964 (telephone 914/359-2900, ext. 325).

IUGG Quadrennial Report Overview: Physical Oceanography

Ants Leetmaa

NASA Atlantic Oceanographic and Meteorological Laboratories, Miami, FL 33149

To a great extent, this U.S. physical oceanographic report to IUGG (1979–1982) focuses on advances made in large-scale oceanography. Reviews are presented for the areas of equatorial oceanography, subtropical gyre studies, polar oceanography, mid-latitude variability, and oceanic heat flux. The last topic is a common thread that runs through all the reviews since there is the realization that the ocean is an essential element in determining the climate of the earth. With increased concern over the coastal zone as a region where recreational, commercial energy, and fisheries interests overlap, a great deal of effort has also going into investigating the oceanography of the continental margins. Since no review of coastal oceanography occurred in the last report, this report has an extensive discussion of what has been learned in the last eight years. The benthic boundary layer, for the same reasons, has received considerable attention, and a review is dedicated to this. What appears as bothersome noise to the investigator of the large scale can be interesting physics in itself. The disciplines of wriggly lines are being put on firm physical basis as discussed in the reviews on small-scale physics and internal waves. In each of these areas advances have come as a result of new instrumentation, new measurements, and new ideas. Often progress has been slowed because of the inability to observe phenomena in their entirety. Remote sensing promises to be a great aid in that respect. The work during the last four years in that area has shown these techniques to be invaluable for studying phenomena from small to large scales. Unfortunately, the main payoff from remote sensing awaits new satellites that use sensors such as the altimeter operationally. In the short overview that follows, no individual works are mentioned. These can be found by reference to the appropriate review.

The main focus in equatorial oceanography has been on low-frequency motions with a strong interplay between observations, theory, and modeling. Linear wave theory appears to be capable of describing much of the variability that has been observed whether it be the onset of the Somali Current in the Indian Ocean, seasonal adjustments of the equatorial Atlantic, or the El Niño phenomena in the Pacific. Local as well as remote responses to wind changes appear to be important. El Niño simulations have been conducted with models using real winds with encouraging results. It has been recognized that the tropical Pacific plays a major role in interannual climate variability. Episodes with anomalously warm sea surface temperatures correlate with mid-latitude winter response. Progress is being made on understanding the origin of this sea surface temperature variability and the mechanisms of atmospheric teleconnections to mid-latitudes. Models are being used to simulate actual sea surface temperature distributions. As this is being written, a major warming of the Pacific—perhaps the event of the century—is taking place with global atmospheric manifestations. Many of the ideas developed these past four years will be refined or rejected as will be reported in the next Quadrennial Report.

A main focus of research on mesoscale variability in mid-latitudes has been basin-wide explorations of eddy properties and the search for eddy energy sources. Out of this has developed a zero-order description and rationalization of the eddy field. A dominant feature of the eddy field is its horizontal inhomogeneity which is related to the pattern of the general circulation. The eddies seem to be generated via instabilities of the strong mean flows and propagate away from these regions. They play an important role in driving recirculations near these strong flows but they don't seem to play a crucial role in the dynamics of the mean flow in the ocean interior. Direct transient wind forcing generates a much lower level of eddy energy activity which is the background signal over most of the subtropical gyre. Eddies can also be generated by instabilities associated with abyssal thermohaline circulations.

With the realization that eddies probably play a minor dynamical role over most of the gyre, a resurgence has occurred in studies of the subtropical gyre. Renewed attention has been paid to collection of new hydrographic sections and analyses of old data. New insights have developed from studies of geochemical tracers. These observations and techniques such as [grb]-spiral computations and inverse modeling and their application have been used to study the dynamics and structure of the gyres. Theoretical studies were made of the mechanisms by which water is pumped out of mixed layers into the interior and what determines the vertical structure of the gyres. New techniques such as acoustic tomography are being developed to make large-scale integrated measurements.

One motivation for these studies is the realization that at mid-latitudes the poleward oceanic heat transport is comparable to that by the atmosphere. This conclusion was based on indirect estimates obtained both by studies of the surface heat budget of the ocean and from atmospheric and satellite radiation measurements. Such investigations give no information about how these transports occur in the oceans. Recent studies using hydrographic and geochemical data provide in-situ estimates which are comparable with the indirect ones. The errors in these direct calculations are no larger than those associated with the indirect techniques. Also, they give information on the mechanisms of the heat transport in the ocean. Inverse theory has also been used for these computations. New applications of the indirect techniques using larger data sets and computer processing have allowed estimates to be made of the heat transport in each ocean basin.

A major emphasis in Arctic and Antarctic oceanography has been studies of the mechanisms and rates of water mass formation and the effects of deep convection. Rates of ventilation have been determined with the aid of geochemical tracers such as tritium and stable oxygen isotopes. Descriptions of equatorward spreading have been inferred from water mass properties and direct current measurements in deep channels. In the Arctic and Antarctic the processes occurring along the continental margins have been shown to be important in determining the offshore water mass and circulation patterns. Direct measurements in the Drake Passage have put bounds on the transport of the Circumpolar Current. Mesoscale variability, which results from baroclinic instability and fine structure intrusions that occur across fronts, could be major factors in the poleward heat transport. Progress has been made in modeling of sea ice and understanding ocean-ice-glacial ice interactions and how these affect the heat flux to the atmosphere.

Studies along the continental margins of the United States have concentrated primarily on obtaining basic descriptions of the currents and hydrography. Physical factors such as stratification, fresh water inputs, ice, shelf width and depth, local and remote wind forcing, tidal forcing, and proximity to strong offshore currents can all effect circulation patterns. Hence, the circulation on different shelves can be controlled by different processes. For example, the circulation on the outer shelf in the southeastern United States is dominated by eddies from the Gulf Stream. Further north along the Georges Bank, tidal flows and tidal rectification are major factors. By in large, however, wind forcing, whether local or remote, is important on all shelves. Coastally trapped free waves have been identified; hence, local variability does not necessarily correlate with local wind changes. Along the coast of Peru energy from the equatorial wave guide appears to be present. On some shelves the seasonal and monthly mean circulations as well as the low-frequency variability has been established. Bathymetry exerts a strong control, especially on low-frequency motions. This results in along-isobath coherences being much greater than those across the depth contours. Dynamical studies have lead to an understanding of some of the dominant balances. Mechanisms that can lead to cross shelf exchanges have been identified; however, no clear picture exists yet as to how important each of these is.

A major problem facing investigators of the benthic boundary layer in 1979 was understanding the specific mechanisms that were important at the top and bottom of the boundary layer. Since then, notable progress has occurred. Specific areas include: (a) parameterization of distributed roughness on the sea floor; (b) including the effects of stratification due to density and suspended sediment on vertical mixing; (c) understanding wave-current interactions, where the mean current is now parameterized as an increase in apparent roughness; and (d) understanding the effects of biological activity on critical entrainment stresses. A measure of the progress is that all these effects are now routinely incorporated in models of mobile bed flow. This required an understanding and evaluation from field data of the effects of stratification and bed roughness on the scaling parameters, such as z_0 and U^*, that describe the viscous sub-layer and logarithmic regions of the simple boundary layer models. Von Karman's constant is proclaimed to be 0.41.

During the past four years progress has been made in measuring and interpreting small-scale temperature and shear spectra. In the latter case a complete spectrum over wavenumber has been constructed and this shows regions that are consistent with classical ideas of three-dimensional turbulence. The importance of small scale process in controlling two large-scale processes has been demonstrated. In the equatorial region, the dissipation of kinetic energy above the Equatorial Undercurrent has been shown to occur at the same rate that the zonal pressure gradient puts energy into this flow. In mid-latitudes salt fingering appears to be a factor in controlling the relationship between temperature and salinity. However, the extent of fingering in central waters is still unknown. Nor is it understood why, in general, fingering is less ubiquitous than expected. Sensor development, new measurements, and testing of ideas have gone hand in hand. Progress has resulted from a better understanding of the sensors used for studying the microscale and the interaction between these and the environment. New instruments have been developed that are more reliable and better matched to sampling needs.

Garrett and Munk developed in the seventies a universal deep-ocean spectrum of the internal wave field that described its energy levels and coherence structure. As was true four years ago, observational efforts are still underway to find deviations from this universal spectrum. Not surprisingly, deviations have been found where the model was not meant to apply: near bottom sloping boundaries, islands, the ocean surface, the equator, at the inertial frequency, regions where N varies rapidly, and at high frequencies near the spectral roll-off. Theoretical efforts use ideas of weak and strong interactions to obtain stochastic descriptions of the wave field. The validity of the weak-interaction models is being tested. A goal of the theoretical studies is to understand the flow of energy through the wave field and to identify its sources and sinks. This has proven difficult since the waves apparently are unforced most of the time and only slowly receive or lose energy. Although much of the internal wave activity can be described efficiently using statistical measures, some phenomena have dominant frequencies or wavelengths. Work in this category includes observational and model studies of the internal tide and solitary waves which are generated by the internal tide flowing over ridges and sills.

Advances in remote sensing in oceanography have resulted from quantitative use of active and passive sensors for the ocean color, wind stress, sea level, and drifting buoy tracking. A better understanding now exists of the sensors and how they can be used. Emphasis has been on technique application to specific problems. It is believed that sea surface temperature can be determined with an rms error of 0.6°C. Satellite determinations of sea surface temperature are used in operational forecasts and mapping ice front locations and motion. Data from infrared sensors have also been used extensively in pattern recognition studies of the variability of fronts associated with subtropical fronts, the Somali Current, equatorial wave phenomena, western boundary currents, and detached Gulf Stream rings. Ocean color studies have found application in studies of warm core Gulf Stream rings, sediment plumes, and chlorophyll distributions. Studies were conducted of the accuracy and precision of altimeters. The precision is about 5 cm, but accuracy is limited by the problems of not knowing the geoid accurately. Altimeter data has been used to study mesoscale eddy variability, wave and swell height distributions, and determination of wind stress. Most studies have been done with experimental sensors. More general application of these techniques awaits operational sensors.

Contents: IUGG Quadrennial Report *Physical Oceanography*

U.S. National Report to IUGG 1979–1982

Eos is periodically publishing the 12 overviews appearing in the *U.S. National Report to the International Union of Geodesy and Geophysics 1979–1982*. The U.S. National Report is being published by AGU on behalf of the U.S. National Committee in four extra issues of *Reviews of Geophysics and Space Physics* (RGSP). The discipline overview appearing here was published with its associated papers (see Contents list at the end of the overview) in volume 21, number 5, June 1983 of RGSP.

Subscribers to RGSP will automatically receive the four extra RGSP issues containing the U.S. National Report. All four extra issues will have been mailed by July 1983. The four regular issues of RGSP are appearing as usual in February, May, August, and November. Those who do not subscribe to RGSP can still obtain the entire U.S. National Report by entering a subscription to RGSP. In addition, the report of each discipline will automatically be mailed separately to those members of AGU for whom that discipline is their primary AGU section affiliation; this separate distribution is made possible by grants from the Defense Mapping Agency, National Aeronautics and Space Administration, National Oceanic and Atmospheric Administration, National Science Foundation, Office of Naval Research, and U.S. Geological Survey.

News & Announcements

Drilling Reorganizes

As the first in a proposed series of steps that would move scientific ocean drilling from its own niche within the National Science Foundation's (NSF) Directorate for Astronomical, Atmospheric, Earth, and Ocean Sciences (AAEO) into the agency's Division of Ocean Sciences, Grant Gross, division director, has been appointed acting director of the Office of Scientific Ocean Drilling (OSOD). Gross will retain the directorship of the division, which also is part of AAEO. Allen M. Shinn, Jr., OSOD director for nearly 2 years, has been reassigned effective July 10 to a position in NSF's Office of Planning and Resource Management.

The move aims to tie drilling operations more closely to the science with which it is associated, Gross said. This first step is an organizational response to the current leaning toward using a commercial drilling vessel as the drilling platform, he said. Before the market for such commercial drill ships opened (*Eos*, February 22, 1983, p. 73), other ship options for scientific ocean drilling included refurbishing the aging *Glomar Challenger* or renovating, at great expense, the *Glomar Explorer*. A possible next step in the reorganization is to make OSOD the third section within the Ocean Sciences Division. Currently, the division is divided into the Oceanographic Facilities and Support Section and the Ocean Sciences Research Section.

"I think it is a perfectly appropriate organizational move as the program nears the end of the transition from the Deep Sea Drilling Project to the Advanced Ocean Drilling Program," Shinn told *Eos*.

The fiscal 1984 budget request for drilling will remain at $26.3 million, Gross said.

In a separate but related item, Congress has given the green light to the fiscal 1983 budget reprograming request for scientific ocean drilling; the request was made on May 21 by NSF Director Edward A. Knapp. House and Senate appropriations committees voted to reprogram $4.5 million to drilling from undistributed amounts within NSF's fiscal 1983 budget for research and related activities. Two million dollars would go to the completion of the Deep Sea Drilling Project, which is using the *Glomar Challenger*, and the remaining $2.5 million would be used to initiate site surveys and geophysical work, to start the procurement planning process, and to develop a request for proposals for the selection of a drilling ship in preparation for AODP.—*BTR*

EOS

Transactions, American Geophysical Union

The Weekly Newspaper of Geophysics

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Cover. 1983 William Bowie Medalist Syun-iti Akimoto (see page 446).

Baker Heads JOI

D. James Baker, Jr., dean of the College of Ocean and Fishery Sciences at the University of Washington in Seattle, has been appointed to a 2-year term as president of the Joint Oceanographic Institutions, Inc. (JOI), a consortium of 10 academic oceanographic institutions. Baker, who has been working part-time in the position since May 15, will begin working full-time at JOI on November 1. Baker will be on leave from his post at the University of Washington while he is at JOI headquarters in Washington, D.C.; an interim dean has not yet been appointed.

Among the tasks Baker envisions for JOI is to work with other groups, including such National Research Council boards as the Board on Ocean Science and Policy (BOSP), on a long-range plan for the use of satellites in oceanography. Baker is a member of BOSP. JOI also plans to submit a proposal on July 15 to the National Science Foundation for the management of the Advanced Ocean Drilling Program (AODP) with Texas A&M University as the scientific operator. A decision on the proposal is expected in early fall, Baker said.

JOI was formed in 1976 to bring the collective capability of individual institutions to bear on large oceanographic research projects. In 1978, JOI began to plan and manage geological and geophysical ocean exploration by the institutions involved in the scientific planning and management of the Deep Sea Drilling Project.—*BTR*

Meetings

Ocean Surface Studies

A Symposium on Wave Breaking, Turbulent Mixing, and Radio Probing of the Ocean Surface will be held July 19–25, 1984, in Sendai, Japan. New research results in the field of dynamics and satellite measurement of the ocean surface and the related upper ocean processes will be presented at the meeting. Following the meeting, a Workshop on Modeling the Upper Ocean Boundary Layer for the World Climate Research Panel (WCRP) Objectives will be held July 26–27, 1984.

The three major topics to be covered include ocean waves (dynamics, nonlinear waves, wave breaking, and structure of the ocean surface); turbulent mixing in the surface layer of the ocean (physics of ocean mixed layer, response of ocean to atmospheric disturbances, and upper ocean variability); and radio probing of the ocean surface (microwave scatterometry, radiometry, altimetry, SAR/SLAR, two-frequency radar, and physical processes pertaining to electromagnetic scattering at the sea surface).

Deadline for submission of abstracts is November 1, 1983. Abstracts should be limited to one page and be forwarded to Y. Toba, Department of Geophysics, Faculty of Science, Tohoku University, Sendai, 980 Japan. The proceedings of the meeting will be published.

Financial support is available for young U.S. scientists who wish to attend the symposium. For additional information on the symposium and on financial support, contact, before November 1, 1983, O. M. Phillips, Department of Earth and Planetary Sciences, The Johns Hopkins University, Baltimore, MD 21218 (telephone: 301-338-7036).

The Symposium on Wave Breaking, Turbulent Mixing, and Radio Probing of the Ocean Surface is a joint activity of the Committee on Climatic Changes and the Ocean (CCCO) and the Joint Scientific Committee (JSC) for WCRP.

Opinion

Ocean Science Leadership—A Desperate Need That Could Be Met

U.S. ocean science is at a critical stage. Though many exciting discoveries have been made recently, the field has been essentially level funded for several years, costs of operations are increasing faster than inflation, and there is no reasonable expectation for much improvement in the near future. At the same time, new technologies that are "off the shelf" or just over the horizon can provide orders of magnitude increases in precision, rates of data acquisition, and synoptic ocean-basin-scale and even global-scale coverage of ocean phenomena. The use of these technologies (for a price) would result in substantial advances in understanding fundamental oceanographic problems (such as the global ocean circulation) during the next decade. Several large-scale, regional programs to start this process are on the drawing boards or in advanced stages of planning. Clearly, there are more ideas for utilizing the talents of our nation's oceanographers than there are reasonably obtainable funds or talent to undertake them.

Under these circumstances, there are three obvious scenarios: (1) In the absence of a strong signal from the community as to its major priorities, all of the plans and programs will be stretched out, a few will be partially implemented, and time will run out on others that require the development of essential tools such as satellites; or (2) in the absence of a clear signal from the community, decisions will be made from outside that will determine the success or failure of programs based more on political, economic, and social implications than on scientific merit; or (3) the community will rally around a leader or a group that will play a major role in establishing priorities that are based primarily on scientific need.

In the 1960s, when U.S. oceanography was growing rapidly, the National Academy of Sciences (NAS) Committee on Oceanography (NASCO) and the federal agency Interagency Committee on Oceanography (ICO) provided a remarkably effective mechanism for guiding the development of U.S. oceanography. With the three "giants" of our field in those days—Roger Revelle, Maurice Ewing, and Columbus Iselin—on NASCO, a consensus could be reached fairly quickly as to the needs and priorities (a consensus that was welcomed by the ICO and leaders in Congress), and Revelle, Ewing, and Iselin could go back to their laboratories and tell their principal investigators where and how the future would develop. However, after 10 years of rapid growth, U.S. oceanography came of age, and the early simplicity that many of us remember fondly disappeared. The U.S. Hydrographic Office became the U.S. Oceanographic Office, and national leadership was assumed by the Stratton Commission (a group with much broader interests and concerns than ocean science). Later, we had a National Advisory Committee for Oceans and Atmosphere combing ocean *and* atmosphere interests and retaining the breadth of overview inherited from the Stratton Commission. Oceanography had become too important for oceanographers and, in addition to attracting substantial amounts of support, attracted the attention and participation of lawyers, economists, sociologists, and politicians.

I'm not suggesting that inputs from a broad segment of our nation are not appropriate. Clearly, it is the *use* of oceanographic knowledge that justifies the support of basic research by federal agencies with applied missions and the importance of maintaining and increasing the scientific basis for additional knowledge that justifies NSF's major role in the support of oceanographic research. However, the fact is that with the maturity of our field and the growing awareness of its importance to our nation, the leadership that once spoke for oceanography as the science for understanding how the oceans work became submerged and diffused.

The NAS Committee on Oceanography reflected that process up to a point. Starting as a *science* oriented group in 1957, NASCO broadened into an Ocean *Affairs* Board from 1973 through 1975 but then refocused as an Ocean *Sciences* Board from 1976 through 1982. Now, combined with the Ocean Policy Committee as the Board on Ocean Science and Policy (BOSP), it is back again to something equivalent to the old Ocean Affairs Board.

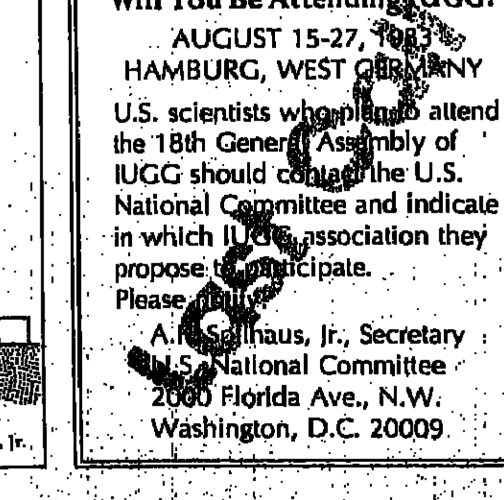
Over the 25 year span that started with NASCO, there have been several notable successes (and a few fizzles) but nothing as successful as the set of reports under the banner "Oceanography 1960 to 1970" that provided a comprehensive overview of the major ocean science problems that needed to be addressed and the ships, laboratories, manpower, and funds (laid out in a 10-year schedule of development) needed to do the job. Perhaps a similar overview of our needs will not be produced again. However, I believe that it can be done and that such a review is necessary if our community is to come close to realizing the achievements that are possible during the next decade. The task will certainly be harder than it was in the late 1950s, but it can be done if (1) BOSP decides that this task is its most important and primary reason for existence; (2) BOSP prepares a plan to undertake this task that broadly involves the entire oceanographic community (by correspondence, workshops, etc.) as much as is feasible; (3) the community (perhaps aided by The Oceanography Report (TOR) of *Eos*) agrees that BOSP leadership in undertaking such a study is needed; and (4) the community participates generously in the work that must be done. I call upon TOR readers to express their views on this issue to BOSP members.

Dick Vetter

Dick Vetter, former Executive Secretary of NASCO, can be contacted in care of the Marine Technology Society, 1730 M Street, N.W., Washington, DC 20036.

BOSP Members

The new Board on Ocean Science and Policy (BOSP) (*Eos*, June 7, 1983, p. 402) met for the first time on May 4. John B. Slaughter, former director of the National Science Foundation and now chancellor of the University of Maryland in College Park, is the board's chairman. Other board members are D. James Baker, Jr. (University of Washington, Seattle); Kirk Bryan (Geophysical Fluid Dynamics Laboratory, Princeton University); John P. Craven (University of Hawaii); Charles L. Drake (Dartmouth College); Paul M. Fye (Woods Hole Oceanographic Institution); Edward D. Goldberg (Scripps Institution of Oceanography); G. Ross Heath (Oregon State University); Judith T. Kildow (Massachusetts Institute of Technology); John A. Knauss (University of Rhode Island); James J. McCarthy (Museum of Comparative Zoology, Harvard University); H. William Menard (Scripps Institution of Oceanography); C. Barry Raleigh (Lamont-Doherty Geological Observatory); Roger Revelle (University of California, San Diego); David A. Ross (Woods Hole Oceanographic Institution); Brian J. Rothschild (University of Maryland); William M. Sackett (University of South Florida); John H. Steele (Woods Hole Oceanographic Institution); and Carl Wunsch (MIT). Wallace Broecker (Lamont-Doherty Geological Observatory), an original board member, resigned after the first meeting. Broecker told *Eos* that combining the science and policy boards resulted in a new board whose mission is too broad. A new board member will be appointed in Broecker's place.—*BTR*



Charles C. Sarabun, Jr.

News *(cont. from p. 441)*

crises, known previous eruptions have been accompanied by jökulhlaups. The new eruption was preceded by an intense earthquake swarm that began at about 0400 on May 28. The largest earthquakes were in the magnitude range 3–3.5. Earthquake activity declined at about 1000, and soon after that bursts of volcanic tremor began to appear on the seismograms. The tremor amplitude increased at about 1500, and intense bursts of tremor were recorded for the rest of that day and the next. During the following days the tremor gradually decreased in amplitude.

"The first definite observation of the eruption was on May 29 at 1030 from an overflying aircraft, diverted to fly over Grímsvötn by request from seismologists. At that time, the eruption had broken through the ice and produced a 3-km-long very thin ash fan downwind on the ice cap to the south of Grímsvötn. Steam clouds were observed in the direction of Grímsvötn on May 28 at about 2115. Weather satellite images on May 29 show a long narrow cirrus cloud that almost certainly originated at Grímsvötn during the morning of May 29, at 0300 at the latest.

"When the eruption was observed on May 29, an opening had formed in the ice shelf inside the caldera near the SW wall. This lake was oval shaped, about 300 m in diameter, and, during May 29, was covered by raft ice from the overhanging caldera wall. Explosions were observed in the lake at varying time intervals. The highest explosions reached about 50 m, but the accompanying steam columns reached 1–2 km. During the next few days, weather conditions prevented direct observations except the height of the steam column. On May 30, a maximum height of 6–7000 m was observed; on May 31, 7–8000 m; and on June 1, about 5000 m. The steam column was intermittent but never continuous. After that, no activity has been observed, but on June 5 a small island was observed in the steaming lake.

"No change has been observed in the rivers that drain the glacier. At this time, it is not known whether the eruption has affected the lake level within the Grímsvötn caldera."

Information contacts: Karl Grönvold, Nordic Volcanological Institute, University of Iceland, Reykjavík, Iceland; Páll Einarsson and Helgi Björnsson, Science Institute, University of Iceland, Reykjavík, Iceland.

Earthquakes

The May 2 earthquake, centered in the San Joaquin Valley, was felt across central and S California and in W Nevada. Hardest hit was Coalinga, where 90% of the business section and 20% of the homes were destroyed or damaged beyond repair. Of the 48 persons injured, two remain in serious condition; no one was killed.

The earthquake on May 10 occurred in St. George's Channel, between New Britain and New Ireland, about 40 km SE of Rabaul, New Britain, Papua New Guinea. No damage or casualties were reported. The May 15 shock in E Madison County about 60 km E of St. Louis, Missouri, was felt from NE Arkansas to SW Indiana, especially in SE Missouri and S Illinois. Windows broke in New Athens, Illinois, about 65 km SSW of the epicenter. The epicentral area is about 160 km N of the N end of the New Madrid fault zone, and is not associated with it.

At least 13 persons died in the May 26 earthquake that struck N Honshu and S Hokkaido. Another 47 were drowned, and at least 55 were missing and feared killed by the tsunami that followed it. The earthquake was centered in the Sea of Japan about 120 km NW of Akita, the most seriously damaged city, where the intensity was 5 on the Japan Meteorological Agency scale of 7. Within 30 min of the main shock, tsunami of 3–4 m height swept the NW Japanese coast. Most casualties and damage occurred N of Akita, along the Oga Peninsula and in Noshiro and Jusanko on Honshu; at least 159 boats were destroyed. In Korea, three persons were drowned by tsunami, 64 ships lost, and 10 homes washed away. Tsunami arrived on the USSR's Maritime Territory coast an hour after the earthquake. Near Vladivostok, several ships were damaged and a person washed overboard. Farther north a fishing fleet was damaged.

Information contact: National Earthquake Information Service, U.S. Geological Survey, Stop 967, Denver Federal Center, Box 25046, Denver, CO 80225 USA; Larry Larson, Fresno Bee, Fresno, CA 93786 USA; Roy Manning, Fresno County Office of Emergency Services, Suite 800, 2220 Tulare, Fresno, CA 93721 USA; Mark T. Woods, St. Louis University, Geophysics, Box 8099, LaClede Station, St. Louis, MO 63156 USA; Tokiko Tiba, National Science Museum, Department of Geology, 3-23-1 Hyakunin-cho, Shinjuku-ku, Tokyo 160, Japan; George Pararas-Carayannis, International Tsunami Information Center, P.O. Box 50027, Honolulu, HI 96850 USA; The Japan Times, Tokyo, Japan; Kyodo News Service, Ltd., Kyodo, Japan; Sovetskaya Rossiya, Moscow, USSR; United Press International.

Date	Time, GMT	Magnitude	Latitude	Longitude	Depth of Focus	Region
May 2	2349	6.5*	36°25'N	120°30'W	10 km	Cent. California, USA
May 10	1827	5.5 m_b, 6.7M_s	4°58'S	152°51'E	shallow	New Britain
May 15	0516	4.4m_{bLg}	38°74'N	89°50'W	11 km	SW Illinois, USA
May 26	0300	7.8M_s	40°36'N	139°09'E	shallow	Honshu, Japan

*6.5ML, University of California at Berkeley.

Meteoritic Events

Fireballs: Germany; mid-Atlantic area, Georgia, Nebraska, Pennsylvania, USA

Geophysicists

William I. Axford, vice chancellor of Victoria University in New Zealand, was recently elected a foreign associate of the National Academy of Sciences (*Eos*, June 14, 1983, p. 412)

Eddie N. Bernard has been appointed director of the Pacific Environmental Laboratory in Seattle, Wash., a major oceanographic research facility of the National Oceanic and Atmospheric Administration (NOAA). As acting director of the laboratory for the past year, Bernard, a physical oceanographer, has directed a number of NOAA research projects involving marine geochemistry, ocean circulation, marine resources, and ocean-atmospheric interactions.

John T. Jefferies, an astrophysicist specializing in stellar atmospheres and other astrophysical plasmas, has been appointed director of the newly consolidated National Optical Astronomy Observatories (NOAO). The Association of Universities for Research in Astronomy, Inc. (AURA) operates the facilities under contract with the National Science Foundation. Headquartered in Tucson, Ariz., NOAO will include three observatories: Kitt Peak National Observatory (with facilities in Tucson and on Kitt Peak), the Cerro Tololo Inter-American Observatory (with facilities in La Serena, Chile, and on Cerro Tololo in the foothills of the Andes), and the National Solar Observatory (a recently formed facility consisting of the solar instruments on Kitt Peak and Sacramento Peak in New Mexico).

On July 1, ***Richard S. Lindzen*** became a professor in the Massachusetts Institute of Technology's new Department of Earth, Atmospheric, and Planetary Sciences. Lindzen, formerly the Robert P. Burden Professor of Dynamic Meteorology at Harvard University, will hold the Alfred P. Sloan Chair in meteorology. He is a recipient of AGU's Macelwane Award and the Meisinger Award of the American Meteorological Society. He is a member of the National Academy of Sciences.

T. N. Narasimhan, staff senior scientist of Lawrence Berkeley Laboratory's Earth Sciences Division, now has a concurrent appointment as professor-in-residence in the Department of Materials Science and Mineral Engineering of the University of California, Berkeley.

Eric S. Posmentier, chairman of the Marine Sciences Department at Southampton College of Long Island University, and visiting associate professor of atmospheric sciences at Dartmouth College, received Long Island University's Trustees Award for Scholarly Achievement.

Charles M. Telesco, National Academy of Science Research Fellow at NASA's Ames Research Center, has accepted a position at the Space Science Laboratory of NASA's Marshall Space Flight Center in Huntsville, Ala.

In Memoriam

The following AGU members are recently deceased:

Marinus Maasland, 58, died March 20, 1983. A member of the Hydrology section, he joined AGU in 1956.

John Zimmerman, 65, died May 4, 1983. A member of the Ocean Sciences section, he joined AGU in 1953.

Books

The Three Voyages of Edmond Halley in the *Paramore*: 1698–1701

Norman J. W. Thrower (Ed.), Hakluyt Society, London, 1981, £20.

Reviewed by Duncan Carr Agnew

On Thursday, October 20, 1698, a three-masted ship, captained by Edmond Halley with orders "to improve the knowledge of the Longitude and variations of the Compasse," which he was to observe "with all the accuracy you can," set sail from Deptford, England, on the first leg of the first voyage ever commissioned for strictly scientific purposes. Halley is now best known as an astronomer and for the comet that bears his name. However, his interests ranged over so many specialties that he is better described now by the 17th century title of "natural philosopher." Among his various areas of study, the study of the earth took a major place, as shown by his many papers on the trade winds, the tides, and especially the magnetic field. This last interest led him to propose to the Royal Society that he make a voyage around the world "to discover what may be learnt . . . [of] the variations of the Magneticall Needle." This ambitious undertaking was later scaled down to cover only the Atlantic Ocean, Halley made two voyages from 1698 to 1700, at one point reaching 52°S in his 52-foot vessel. As a tail-piece he made a third voyage in the summer and fall of 1701 to study the tides and tidal currents of the English Channel.

All this is set out in sumptuous detail in this edition of Halley's journals, issued by the Hakluyt Society as one of their publications of records of travel and exploration. Thrower has done a model job of editing the journals, reproducing the original format so far as printing will allow, and noting all significant variants between the manuscript available and the versions published by Dalrymple in 1775. He has also provided an informative introduction and footnotes and printed all the supporting documentation in a section following the journals. This additional material well supplements the sometimes dry journal entries and provides an informative glimpse of the background of the three voyages.

In addition to the volume of text, the publication includes a portfolio of two of Halley's maps, reflecting the editor's cartographical expertise. One map is the earliest version of the famous magnetic chart, the first use of isogonic lines and distant predecessor of the IGRF (it even includes information on secular variation). The other, in two sections, is the map of tides in the English Channel. All in all, this publication of this work is an excellent contribution to the history of geophysics, of navigation, and of Halley.

Duncan Carr Agnew is with the Institute of Geophysics and Planetary Physics, Scripps Institution of Oceanography, La Jolla, CA 92093.

Classified

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Replies to ads with box numbers should be addressed to Box ___, American Geophysical Union, 2000 Florida Avenue, N.W., Washington, D. C. 20009.

For further information, call toll free 800-424-2488 or, in the Washington, D. C., area, 462-6903.

POSITIONS WANTED

Hydrogeologist. M.Sc. and 10 years experience both U.K. and overseas seeks position outside U.K. Experience in digital modelling, project appraisal, resource evaluation, aquifer thermal energy storage and lecturing/training. Fluent Spanish. Box 019, American Geophysical Union, 2000 Florida Avenue, N.W., Washington, D.C. 20009.

POSITIONS AVAILABLE

Florida International University/Faculty Positions in Geology. The Earth Sciences program at Florida International University is expanding and plans to increase the number of its faculty positions in the next few years. In order to complement existing instructional and research strengths, the university invites applications for tenure track positions at the assistant professor level in the following areas of specialization.

1. Stratigraphy/Sedimentology
2. Geophysics/Marine Geology
3. Igneous Petrology/Geochemistry/Economic Geology

Successful applicants must have demonstrated an ability to conduct high-quality teaching and the potential to establish a productive research program in their area of specialty.

Subject to final approval of funding, appointments will begin in August 1983 (deadline for application July 30, 1983) and/or January 1984 (deadline for application November 15, 1983).

Send a resume, brief description of teaching and research interests, transcripts and three letters of recommendation to:

Dr. L. Keller
Department of Physical Sciences
Florida International University
Tamiami Trail, Miami, Florida 33199

Florida International University is a member of the Florida State University system and an affirmative action/equal opportunity employer.

Mass Spectrometry/Washington University. The Department of Earth and Planetary Sciences of Washington University in St. Louis has an opening for a mass spectrometry specialist in our isotope laboratory. This position will involve responsibilities for the operation and maintenance of the laboratory as well as opportunities for collaborative and independent research in isotope geochemistry. A Ph.D. in physical science and prior experience in thermal emission spectrometry are highly desirable. Closing date for applications is September 15. Send vita to F.A. Podosek, Department of Earth and Planetary Sciences, Washington University, St. Louis, MO 63130.

Washington University is an equal opportunity/affirmative action employer.

Physical Oceanography/University of Rhode Island. A postdoctoral research associate position is available starting October 1, 1983 for studies of tropical processes in the Pacific. The research involves the collection and analysis of data relating to the dynamic topography and zonal pressure gradients of the equatorial current systems as part of a long-term study of ocean influences on climate. Submit resume and professional references by August 15, 1983 to: Dr. D. Randolph Watts, Marine Research Associate II Position, UNIVERSITY OF RHODE ISLAND, P.O. Box 357, Kingston, Rhode Island 02881.

An affirmative action/equal opportunity employer m/f.

University of Arizona/Faculty Position. The Department of Hydrology and Water Resources invites applications for a faculty position in hydrology with a specialty in ground-water chemistry. Candidates must have training and/or professional experience in hydrogeology and must have demonstrated abilities in the quantitative aspects of the topic. Appointment will be at the level of an assistant or associate professor. Interested individuals should obtain further information from:

Professor Stanley N. Davis
Chairman, Search Committee
Department of Hydrology and Water Resources
University of Arizona
Tucson, Arizona 85721
602-621-3131.

The University of Arizona is an affirmative action/equal opportunity employer.

University of Colorado, Boulder, Geochemist Position. Geochemist with active research program, stable isotopes, radioactive isotopes, and/or trace elements is being sought for a joint appointment in the Department of Geological Sciences and the Cooperative Institute for Research in Environmental Sciences (CIRES) of the University of Colorado.

The one-half time position within the Department of Geological Sciences is tenure track at the assistant or associate professor level with a starting salary of $12,000—$15,000 for the academic year.

Teaching load will be half that of full-time faculty. The position within CIRES will be as a Fellow with appropriate office and laboratory space. One-half academic year salary will be guaranteed by CIRES for two years at the departmental rate, after which incumbent must generate his/her CIRES salary from external sources. Incumbent may augment salary further by generating three months of summer salary from contracts and grants, and consulting.

Applicants with experience, publications, and/or movable existing research equipment preferred. Preferred starting date would be January 1, 1984. Closing date for applications is October 1, 1983.

Applications should include statement of research and teaching interests, experience, a full vitae, and four letters of reference.

Apply to: Professor Charles Stern, Chairman, Geochemist Search Committee, Department of Geological Sciences, Campus Box 250, University of Colorado, Boulder, CO 80309.

The University of Colorado is an equal opportunity/affirmative action, Section 504 employer.

Scientist/Engineer: Airborne Research Associates. Airborne Research Associates has an opening for a versatile self-directed scientist/engineer skilled in electronics and programming to participate in interesting geophysical research. We operate two uniquely instrumented aircraft capable of measuring electric fields, conductivity, the turbulence structure function parameters, and most other meteorological variables as well as conducting photomapping. Flying is done over the ocean and at high altitudes. All work is basic research on our own programs as well as in collaboration with university and government groups. Research areas include thunderstorm and fair-weather atmospheric electricity, sun-weather relationships, turbulence, marine boundary-layer processes and computer controlled satellite image analysis. The company is small with associated advantages and disadvantages. The applicant must be capable of performing many different functions; he/she should be comfortable around aircraft, capable of calibrating and improving instrumentation (including electro-mechanical tasks), flying as observer, reducing and analyzing data, writing reports and articles, and sometimes sweeping the floor and feeding the dog. The job at times involves long hours, field trips and demanding schedules. There is the potential for designing research and initiating new programs. Personnel at the B.A. to Ph.D. level in atmospheric science or experimental physics could fit in. Send resume, salary requirements and three references to: Dr. Ralph J. Markson, Airborne Research Associates, 46 Kendal Common Road, Weston, MA 02193. No phone calls please, will be away until mid-August.

Postdoctoral Position/Naval Postgraduate School. The Ocean Turbulence Laboratory has available a postdoctoral position for a person interested in the analysis and interpretation of oceanic turbulence data. The tenure is for one to two years. The successful candidate should have a Ph.D. in physical oceanography and although experience with turbulence data is preferable it is not essential. The opportunity for involvement in data gathering expeditions is also available.

Resumes can be sent to Dr. R.G. Lueck, Code 68Ly, Naval Postgraduate School, Monterey, CA 93940.

An Equal Opportunity/Affirmative Action Employer.

Seismologist, Geophysicist/Carnegie Institution of Washington. A post doctoral position has just become available at the Department of Terrestrial Magnetism for a seismologist/geophysicist with broad interests. Please mail resume and request three letters of reference to be sent to Geophysics Fellowship Committee, Department of Terrestrial Magnetism, Carnegie Institution of Washington, 5241 Broad Branch Road NW, Washington, D.C. 20015.

Rosenstiel School of Marine and Atmospheric Science/University of Miami. The Division of Marine Geology and Geophysics is seeking candidates for four different faculty positions. For all these positions a Ph.D. degree plus evidence of the ability to obtain funding is a prerequisite. We are seeking candidates who can interact with other faculty members within the Division and the School. The four positions are as follows.

Tenure track position in Geophysics for an individual experienced in heat flow and hydrology of the oceanic crust who can work with geologists and geochemists on studies of hydrothermal circulation. An emphasis on field measurements, which will lead to an understanding of the interaction of hydrothermal circulation with geochemical and tectonic processes, is an important feature of current work. This position is at the Assistant Professor level.

Tenure track position in Marine Paleoecology for an individual interested in reefal or other tropical marine environments. This position will be at the Assistant or Associate Professor level.

Non-tenure track position in Physical Oceanography and fluid dynamics for an individual who can interact with geologists and geochemists on studies of the circulation in ancient oceans. An emphasis on thermohaline circulation with chemical and geological processes is an important feature of current work. This position will be at the Research Assistant Professor level.

Non-tenure track position for a Geochemist with demonstrated experience in the application of stable isotopes to problems of deposition and diagenesis of marine carbonates. This position will be at the Research Assistant Professor Level.

Please send application, including curriculum vitae, statement of research interests, and the names of three referees to Dr. C. G. A. Harrison, Rosenstiel School of Marine and Atmospheric Science, University of Miami, 4600 Rickenbacker Causeway, Miami, Florida 33149, who will pass them on to the relevant search committee.

The University of Miami is an equal opportunity/affirmative action employer.

Research Scientist/Space Plasma Physics, University of Iowa. A research position is available in the Department of Physics and Astronomy, The University of Iowa, for theoretical and interpretative studies of waves in space plasmas. Specific emphasis is on theoretical investigations of wave-particle interactions in planetary magnetospheres and in the solar wind. These investigations are to support the interpretation of data being obtained from spacecraft projects such as Dynamics Explorer, International Sun Earth Explorer and Voyager. The applicant must have a Ph.D. with good qualifications in plasma physics theory and shoud have some experience in the interpretation of space plasma physics data.

Send a resume and the names of three references familiar with the applicant's work to: D.A. Gurnett, Department of Physics and Astronomy, The University of Iowa, Iowa City, Iowa 52242, telephone 319-353-3527.

The University of Iowa is an affirmative action/equal opportunity employer.

Postdoctoral Position in Atmospheric Chemistry and/or Cloud Physics/Georgia Institute of Technology. Recent Ph.D. scientists interested in the development of theoretical models to study the chemistry and physics of precipitation are invited to apply to the Georgia Institute of Technology.

The salary is $18,000/year; period of appointment is one-two years. Applicants should send vita and statement of research interests and the names of two references to: Professor W.L. Chameides, School of Geophysical Sciences, Georgia Institute of Technology, Atlanta, GA 30332.

GEORGIA INSTITUTE OF TECHNOLOGY IS AN EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER.

Iowa State University of Science and Technology, Department of Earth Sciences/Research Associate: Electron Microprobe. The Department of Earth Sciences invites applications for a Research Associate position as an electron microprobe specialist. The appointment will be a fully funded, permanent, twelve-month position. Salary will be commensurate with qualifications.

Primary duties are the operation and maintenance of a fully automated microprobe with WDS and EDS capabilities and the supervision of associated laboratory facilities. Additional duties include the instruction of research personnel in instrument operation. Ample opportunities exist for conducting collaborative and independent research involving the microanalysis of geological materials.

Applicants should have a M.S. degree in a science or engineering field, or equivalent experience, and experience with electron beam instrumentation. Persons with a working knowledge of WDS and EDS spectrometers and the accompanying computer operations and experience analyzing geological samples will be preferred applicants.

Application deadline is July 31, 1983. Later applications will be accepted if the position is not filled. Applications should include a complete resume, a statement of background and interests, copies of publications and names of at least three references. Applications should be sent to:

Bert E. Nordlie
Department of Earth Sciences
Iowa State University
253 Science I
Ames, Iowa 50011

Iowa State University is an equal opportunity/affirmative action employer.

Professor of Meteorolgy/University of Maryland. The Department of Meteorology at the University of Maryland, College Park, invites applications for a tenure line Professorship. We seek a well-established, highly recommended scientist with an outstanding international reputation in atmospheric and oceanic modeling and applications. We propose the establishment of a center to study the interactions of atmosphere, ocean and land processes and their impact on climate variability, and in particular to study the feasibility of short term climate predictions. The applicant should be qualified to head such a Center, plan its projects, organize its activities, and bring to the University the necessary resources to attract outstanding scientists to the Center and to carry out its research functions. Salary is negotiable. To apply, please send a complete vitae and the names of references to the Chairman, Search Committee, Department of Meteorology, University of Maryland, College Park, MD 20742. Applications received by 22 July 1983 will receive full consideration.

the University of Maryland subscribes to policy of equal educational and employment opportunity.

The University of Maryland is required by Title IX of the Education Amendment of 1972 not to discriminate on the basis of sex in admission, treatment of students or employment.

CNOC Chair in Mapping, Charting and Geodesy (Hydrography)/Department of Oceanography, Naval Postgraduate School, Monterey, California. Under the sponsorship of the Commander, Naval Oceanography Command (CNOC) a Chair in Mapping, Charting, and Geodesy (MC&G), with emphasis on Hydrography, has been established in the Department of Oceanography, Naval Postgraduate School (NPS). The objective of the Chair is to promote MC&G studies and research by students and faculty, and to encourage acquaintance of the Chair with Navy needs in the MC&G field.

The incumbent's principal responsibilities will be to conduct research and to supervise student thesis research of a type that will interface the Hydrographic Sciences Program of NPS with the MC&G needs of the Navy. A favored theme is research applicable to operational hydrographic survey problems.

Academic excellence and the ability to bring forth new ideas are the primary considerations in the selection process. The term of appointment will normally be for twelve month periods (1 October to 25 September); however, exceptions will be considered. Candidates may be members of the academic, federal, or private sectors. Where appropriate, Interagency Personnel Agreements are preferable. For further information, contact Professor C.N.K. Mooers, Chairman, Department of Oceanography, Naval Postgraduate School, Monterey, California 93940, telephone number (408) 646-2673. Send curriculum vitae/resume information and letters of interest to interest to the above address.

The Naval Postgraduate School is an Equal Opportunity/Affirmative Action Employer.

Geophysicist/University of Saskatchewan. Subject to final budgetary approval, the Department of Geological Sciences will have a new tenurable position in geophysics available July 1, 1984. Applicants should hold, or be about to receive, the Ph.D. or equivalent degree. They will be expected to teach undergraduate and graduate courses in geophysics and to build and maintain a vigorous research program. Excellent research opportunities exist in crustal and exploration seismology and in all fields of mining geophysics. The department, to occupy a new building in 1985, already has well-equipped geophysical and data-processing facilities. Applicants should send a letter outlining their teaching and research goals, accompanied by a full curriculum vitae including the names of at least three referees, to Dr. W. G. E. Caldwell, Head, Department of Geological Sciences, University of Saskatchewan, Saskatoon, Canada S7N 0W0.

Chairman—Department of Geological Sciences, Wright State University. The Department of Geological Sciences, invites applications for the position of chairman, to be appointed September 1984. We seek a dynamic individual with administrative talent and an appreciation for research and practice-related educational activities. Rank is at the full professor level and no restrictions have been placed on areas of specialization. The department is active with 12 faculty and an emphasis on professional practice, yet maintaining a firm commitment to basic research.

Send a letter of application, curriculum vitae and names of three references to:

Chairman, Search Committee
Department of Geological Sciences
Wright State University
Dayton, OH 45435.

Wright State University is an affirmative action/equal opportunity employer. Closing date for the position is October 31, 1983.

Scientist I/National Center for Atmospheric Research. To work under the supervision of the reactive gases project leader. Will plan and oversee major elements of field experiment; develop analytical techniques appropriate to field and laboratory use; and analyze, interpret and model the data gathered. Requirements include: Ph.D. in atmospheric science or equivalent knowledge and skill, with a strong basic knowledge and skill, with a strong basic knowledge of atmospheric chemical and chemical kenetics; skills in research demonstrated by publications; skills and experience in analytical chemistry of aerosol and gaseous and aqueous atmospheric substances; skill in design, testing and implementation of chemical analytical techniques; skill in development of computational models parameterization of atmospheric, physical and chemical processes, and application of numerical and statistical techniques. Scientist I appointments are for a term of up to three years. Individual may be appointed to the next higher level of scientist in accordance with the UCAR Scientific Appointment Policy. Salary: $25,811 to $37,722 annually. To apply contact: Esther Balzon, (303) 494-5151 extension 581 or send resume and list of publications to NCAR Employment, P.O. Box 3000, Boulder, CO 80307.

An equal opportunity/affirmative action employer.

STUDENT OPPORTUNITIES

Graduate Assistantships/Howard University. Howard University in Washington, D.C., offers new graduate program for the M.S. degree in geoscience; made possible by a grant from the Gulf Oil Company. Areas of specialization are field geology, geophysics, geochemistry, and meteorology/hydrology with remote sensing. Some stipends and assistantships are available. Potential students should write to Dr. Eric Christofferson, Department of Geology and Geography, Howard University, Washington, D.C. 20059.

AGU

1983 William Bowie Medal to Syun-iti Akimoto

Citation

The 45th William Bowie Medal is awarded to Syun-iti Akimoto for his pioneering work in the application of high-pressure, high-temperature research to geophysical problems. It is a great honor and personal pleasure for me to present to you this warm and generous man, whom I have admired and respected for many years, to receive AGU's most prestigious award. Akimoto joins the ranks of other distinguished scientists in the field of mineral physics who have received the William Bowie Medal: Leason Adams in 1950, Francis Birch in 1960, and A. E. Ringwood in 1974.

High-pressure geophysics research was virtually nonexistent in Japan before 1960. In the 22 years since he joined the faculty of the Institute for Solid State Physics (ISSP) of the University of Tokyo, Akimoto has played the leading role in building Japanese high-pressure research as applied to the earth's mantle up to the level where, according to Ted Ringwood, Japan leads the world. Ringwood further attests that, "Akimoto has accomplished this by the example of scientific excellence which he has set in all his research and by his generous encouragement of younger workers."

Two major themes have characterized Akimoto's high-pressure research. He demonstrated the importance of obtaining accurate phase diagrams of major mineral systems as a function of composition, pressure, and temperature. Through quantitative determination of phase transformation boundaries in mantle minerals in the laboratory, Akimoto and his colleagues confirmed the identification of seismic discontinuities in the transition zone (350–1000 km depth) of the earth's mantle with such crystallographic phase transformations. These laboratory data have also been used to estimate the temperature in the transition zone. To make the phase diagrams as accurate as possible, Akimoto devoted considerable time to the establishment of a reliable pressure scale at high temperatures using in situ X ray diffraction techniques. This work is currently being extended by interfacing a cubic anvil apparatus with the synchrotron radiation facility at Tsukuba, Japan.

Akimoto also recognized the importance of constructing large-volume, (compared to diamond anvil) high-pressure, high-temperature equipment in order to conduct research on the physical properties of high-pressure minerals. For this purpose he used many different types of equipment including the tetrahedral anvil, Bridgman anvil, DIA-type cubic anvil, split-cylinder, and slide-type cubic anvil systems. Akimoto was a pioneer in this era of rapid advancement in high-pressure research during which the maximum pressures attainable at elevated temperature in such large-volume equipment increased from the range corresponding to Moho depths into the lower mantle. Invariably, Akimoto improved many technical points of these systems and used them up to their maximum capability. He likes to describe his laboratory to visitors of the Institute of Solid State Physics as a "museum or warehouse of high pressure equipment," but he belied that characterization when he confided to Don Weidner that "only good instruments survive in my laboratory."

Using these large-volume systems Akimoto's laboratory synthesized many high-pressure minerals for physical-properties experiments in his laboratory and also supplied specimens to many scientists and laboratories within Japan and throughout the world for a wide variety of studies: static compression using high-pressure X ray techniques (Bassett, Liu, Mao, Takahashi), elasticity measurements using Brillouin scattering (Weidner), and calorimetry studies of the stability of high-pressure phases (Navrotsky).

At the ISSP Akimoto has spawned a long series of outstanding graduate students (Fujisawa, Ida, Sato, Nishikawa, Yagi, Akaogi, Hamaya, Fukizawa), many of whom are now establishing their own laboratories in universities or industrial companies (and one of whom, Yosiko Sato, is here tonight). Akimoto has also played a role in this field by generously encouraging the development of new laboratories in other Japanese universities and by nurturing the careers of many younger Japanese scientists in these institutions. As is typical of the man, he assiduously avoids any credit for these efforts.

Akimoto obtained his Ph.D in 1950 at the University of Tokyo as a student of Takesi Nagata. He devoted the next 10 years of his career to the study of rock and mineral magnetism at the Geophysical Institute of the University of Tokyo. Following the demonstration by Nagata and Uyeda that self-reversed magnetization was an intrinsic property of certain natural rocks, Akimoto and others synthesized a wide variety of mineral specimens in the laboratory to study the phenomenon of self-reversal. This use of synthetic specimens with controlled stoichiometries was a significant new development in rock magnetic studies. This work was particularly important since, at the time, magnetic field reversals had not yet been demonstrated, and it was believed possible that all observations of reversed remanent magnetism were due to self-reversal. Later, he made important contributions to our understanding of the behavior of magnetic properties in the titanomagnetites and titanohematites.

Although his high-pressure research has been principally devoted to geophysical problems, Akimoto has also made important contributions to the solid-state physics of semiconductors and their thermal and electrical transport properties. Within Japan, Akimoto has cultivated a remarkable, symbiotic relationship between university and industrial programs in high-pressure research. In 1973 the Japan Academy of Sciences awarded Akimoto the Academy Prize for his scientific accomplishments.

Akimoto has admirably represented Japan in international activities ranging from the Upper Mantle Project of the 1960's to the Inter-Union Commission on the Lithosphere of the 1980's. Most recently and most significantly, Akimoto has organized Japan–U.S. seminars on high-pressure geophysics with Murli Manghnani at Honolulu in 1976 and at Hakone, Japan, in 1981. No one who attended the Hakone meeting and the subsequent laboratory tour of Japan will ever forget the scientific excitement or the unsurpassed Japanese hospitality of Akimoto and his countrymen.

In his citation presenting Leason Adams with the William Bowie Medal in 1950, Merle Tuve recalled that the deed of the 1939 gift for the William Bowie Medal specifies that its award is to be for "distinguished attainment and outstanding contribution to the advancement of cooperative research in fundamental geophysics." I can think of few geophysicists who fit this criterion so well. Mr. President, on behalf of his students and colleagues throughout the world, it is my pleasure to present to you the 1983 William Bowie Medalist, Akimoto-sensei.

Robert C. Liebermann

Acceptance

Thank you Mr. President, thank you Dr. Liebermann, and thank you ladies and gentlemen for your generous recognition and your expressions of good wishes. I am deeply honored to be standing here tonight and receiving this distinguished award. When I received the telex from the president of the American Geophysical Union informing me that I was selected as a recipient of the 1983 William Bowie Medal, I saw for the first time the full list of past recipients of the Bowie Medal. I could scarcely believe that I deserved to be called a new member of the Bowie Medalists.

First of all, I must thank my lucky star for being born in a revolutionary era of earth sciences. I have been favored with a number of good fortunes in my career over the past 30 years. My research career started in the field of rock magnetism at Takesi Nagata's laboratory in the Geophysical Institute of the University of Tokyo. At the very beginning of our research career, Seiya Uyeda and I discovered, by chance, a singular rock showing self-reversal of thermo-remanent magnetism. Through the interpretation of this phenomenon, I learned fully the methodology in scientific research and obtained a rich experience in the essentials of interdisciplinary research through collaboration with mineralogists, petrologists, and solid state physicists. This was the first good fortune in my research life.

My next piece of good fortune came in 1961 when I was asked to build a high pressure laboratory at a new institution of the University of Tokyo: the Institute for Solid State Physics. Since it was practically impossible to find a high-pressure experimental physicist in Japan before 1960, I was fortunately able to move from the Geophysical Institute to the new institution. It was advantageous for me to have been able to start high-pressure geophysics research in Japan in the early 1960s.

In the 1950's, Francis Birch and Ted Ringwood, who have been my permanent heroes in earth sciences, had built up a sound foundation in the field of high-pressure geophysics and geochemistry. They conclusively demonstrated the importance of the high-pressure phase transformation of silicate minerals for understanding the earth's deep interior. Thus, in a qualitative manner, I could follow without hesitation the track they had developed. However, in a quantitative manner, there remained many unsolved technical problems at that time concerning the generation of very high pressure, temperature measurements at high pressure, and pressure determination at high temperature. For instance, Francis Birch commented on the uncertainty of high-pressure research in his very famous JGR paper in 1952 as follows. He stated: "Unwary readers should take warning that ordinary language undergoes modification to a high-pressure form when applied to the interior of the earth." Here are a few examples given by him: dubious in the high pressure form means certain, perhaps means undoubtedly, vague suggestion means positive proof. This comparison of the language usage indicates symbolically the state of the art of high-pressure geophysics research in the 1950's. Under the situation, I decided to make it my consistent aim to improve the capability of the high-pressure apparatus and the accuracy of the pressure-temperature measurements.

The first thing to do in my laboratory was to construct a new high-pressure and high-temperature apparatus suitable to our present purposes. I undertook the challenge to build a tetrahedral anvil type of apparatus with large sample volume by using techniques developed in Japan. Fortunately, this choice was quite successful, and the tetrahedral anvil press has been working as well as I had expected for more than 20 years. The success of the tetrahedral anvil apparatus brought a boom in constructing many different types of multi-anvil systems in Japan. I also had the good fortune to have financial support from the Japanese government in constructing some of these multi-anvil systems subsequently developed.

This large volume equipment made it possible not only to carry out research on the various physical properties of minerals and rocks under high pressure and high temperature but also to synthesize many specimens of these high-pressure minerals. It was a great pleasure for me to come into an international collaboration with many distinguished scientists throughout the world by supplying them the samples of high-pressure minerals. Through these collaborations, a number of new devices were developed in my laboratory. For example, the necessities of high quality single crystals of high-pressure minerals for Brillouin scattering experiments stimulated the development of a new technique in crystal growth under high pressure. I would like to emphasize here that the development of new environments always opens a new research field. This is particularly true in high-pressure geophysics research. Successful synthesis of single crystals of high-pressure minerals led to a remarkable advancement in crystal chemistry. The diamond-anvil cell developed by U.S. high-pressure researchers literally opened a window to understanding the deep interior of the earth.

The frontier of high-pressure geophysics research has been constantly shifting to the deeper region of the earth over the past 30 years. My interest in high-pressure phase transformation of upper mantle minerals stimulated by the pioneering studies of Francis Birch and Ted Ringwood is now growing into problems relating to the chemical composition of the earth's core and the core-formation process. I must thank my good fortune to have had the invaluable help of my colleagues and graduate students in adapting my laboratory to the frontier of high-pressure geophysics research in its every stage of advancement. I believe that this is the greatest piece of my good fortune. Without their assistance, no work would have been accomplished in my laboratory. Particularly, on this occasion I would like to express my sincere thanks to Yasuhiko Syono for his important contribution to the construction of my high-pressure laboratory at the initial stage of my research.

Thank you again, Bob Liebermann, for your generous citation. It is a great pleasure to accept this Bowie Medal on behalf of all my colleagues as well as myself.

Syun-iti Akimoto

Nominations for Medals and Awards

William Bowie Medal. Awarded for outstanding contributions to fundamental geophysics and for unselfish cooperation in research.

Maurice Ewing Medal. Honors an individual who has led the way in understanding the physical, geophysical, and geological processes in the ocean; who is a leader in ocean engineering, technology, and instrumentation; or who has given distinguished service to the marine sciences.

Robert E. Horton Medal. Given for outstanding contributions to the geophysical aspects of Hydrology.

James B. Macelwane Awards. Up to three awards are given each year for significant contributions to the geophysical sciences by a young scientist of outstanding ability. Recipients must be less than 36 years old.

Letters of nomination outlining significant contributions and curriculum vitae should be sent directly to the appropriate committee chairmen: *Bowie Medal* - Eugene M. Shoemaker, U.S. Geological Survey, 2255 Gemini Drive, Flagstaff, AZ 86001; *Ewing Medal* - Robert O. Reid, Department of Oceanography, Texas A&M University, College Station, TX 77843; *Horton Medal* - R. Allan Freeze, Department of Geological Sciences, University of British Columbia, Vancouver, B.C., Canada V6T 1W5; *Macelwane Award* - J. Freeman Gilbert, IGPP A-025, University of California/San Diego, La Jolla, CA 92093.

Deadline for Nominations is November 1, 1983.

Membership Applications Received

Applications for membership have been received from the following individuals. The letter after the name denotes the proposed primary section affiliation; the letter A denotes the Atmospheric Sciences section, which was formerly the Meteorology section.

Regular Member

Lisa Anderson (S), Maurice Aubert (GP), Russ T. Brown (H), F. G. Christiansen , Geoffrey B. Crew (SM), Drew K. Davis (H), Walter Dragoni (H), Robert M. Duckworth (S), Charles R. Eastwood (SM), Richard A. Hoover (S), Roberta N. Hoy (H), Paul F. Jessen (O), Raymond C. Johnson (H), Kadri Ercin Kasapoglu (T), Brian G. Katz (H), John B. Kumer (A), Bruce Lautrip (H), Bruce Loftis (H), Charles A. Moo (A), J. Theodore Morine (H), Hakyon E. Morris (S), James L. Muller (S), Neal R. Pettigrew (O), Paul Schopf (O), Pankaj Sharma (O), Mitsu Shimada (V), Joseph L. Shuby (O), Herman Sievering (A), David N. Steinsaltz (T), Keith R. Thompson (O), Thomas J. Trombley (H), Jean Marie Vasicek (GP), Christopher White (H), Barbara L. Yoon (A).

Student Member

Joan Barry (V), Marc Bernstein (V), Leslie Bolsover (V), Enivaldo Bonelli (SA), Nancy A. Breen (T), Russell O. Colson (V), Wesley R. Danskin (H), Laurel A. Di Silvestro (S), James Doherty (H), Mark Stephen Drummond (V), Paul S. Dysart (S), Isang Okon Essien (A), Stephen Fuselier (SS), Kai-Shen Hwang (GP), Timothy H. Keho (S), Rosemary A. Korn (SS), Linda Krakker , Christoph A. Kuth (T), Omar G. Lizano , Philip Lowry , Jonathan I. Lunine (P), Launa M. Maier (A), Ann McNichol (O), Mark A. Meaux (V), Samuel B. Mukasa (V), Wan Mokhtar Nawang (H), Jose Pelaez (O), Suzanne Prestrud (H), Gregory J. Preziosi (S), Suzanne Reynolds (O), Chris O. Sanders (S), Anne Q. Smith (SM), Allan Smith (GP), Charles H. Sword (S), Carlos M. Valdes-Gonzalez (S), Richard J. Walker (V), Brian J. Williams (O), Lorraine W. Wolf (S), Deborah Ann Zankolski (O).

Associate Member

D. G. Browne (H), Jan Falk (H), Itaru Mitoh (S), Rolf Skretteberg (H).

Meetings

Announcements

Groundwater Conference

The Fourteenth Biennial Conference on Groundwater, sponsored by the University of California Water Resources Center and the California Department of Water Resources, will be held in Sacramento, Calif., on September 19–20, 1983.

The various sessions of the conference will deal with such topics as recent groundwater legislation, California groundwater quality, economic issues in groundwater, fractured rock aquifers, and groundwater contamination from pesticides and organic contaminants.

For the first time a limited number of unsolicited papers will be presented in a poster session at the conference. Submit abstracts for the poster session by July 15, 1983, to John A. Dracup, 7619 Boelter Hall, University of California, Los Angeles, CA 90024. Poster specifications will be sent to selected participants by August 1, 1983.

The deadline for registering for the conference is September 14. For more information, contact The Water Resources Center, University of California, Davis (telephone: 916-752-1544).

Geophysical Year

New Listings

The complete Geophysical Year last appeared in the May 31, 1983, *Eos*.

A boldface meeting title indicates sponsorship or cosponsorship by AGU.

September 19–20, 1983 14th Biennial Conference on Ground Water. Sponsors, University of California Water Resources Center and California Department of Water Resources. (The Water Resources Center, University of California, Davis, CA 95616; telephone: 916-752-1544.)

Oct. 23–28, 1983 Symposium on Neotectonics, Seismicity, and Geologic Hazard in the Caribbean and Venezuela, Caracas, Venezuela. Sponsor, INQUA Neotectonics Commission. (André M. Singer P., Depto. Ciencias de la Tierra, FUNVISIS, Apartado Postal 1892, Caracas 101, Venezuela; telex: 26453.)

October 26–28, 1983 29th Annual Midwest Groundwater Conference, Champaign, Ill. Sponsor, Illinois State Water Survey. (Ellis W. Sanderson, Illinois State Water Survey, 605 E. Springfield Avenue, P.O. Box 5050, Station A, Champaign, IL 61820–9050; telephone: 217-333-0235, or Philip C. Reed, Illinois State Geological Survey, 615 E. Peabody Drive, Champaign, IL 61820; telephone: 217-344-1481.)

Dec. 5–16, 1983 Workshop on Pattern Recognition and Analysis of Seismicity, Trieste, Italy. (International Center for Theoretical Physics, P.O. Box 586, I-34100 Trieste, Italy.)

Mar. 28–30, 1984 International Symposium on Earthquake Relief in Less Industrialized Areas, Zürich, Switzerland. (Swiss National Committee for Earthquake Engineering, SIA Postfach, CH-8039, Zürich, Switzerland.)

April 30–May 3, 1984 30th Annual Technical Meeting: Environmental Integration Technology Today for a Quality Tomorrow, Orlando, Florida. Sponsor, Institute of Environmental Sciences. (Institute of Environmental Sciences, 940 E. Northwest Hwy., Mount Prospect, IL 60056; telephone: 312-255-1561.)

June 18–22, 1984 Fifth International Conference on Finite Elements in Water Resources, Burlington, Vt. Sponsors, College of Engineering and Mathematics and Water Resources Research Center, University of Vermont, and AGU. (J. P. Laible, Finite Element Conference, Department of Civil Engineering and Mechanical Engineering, University of Vermont, Burlington, VT 05405.)

June 23–30, 1984 Penrose Conference on Melanges of the Appalachian Orogen, Newfoundland. Sponsor, Geological Society of America. (Brenna E. Lorenz, Department of Earth Sciences, Memorial University of Newfoundland, St. John's, Newfoundland A1B 3X5 Canada.)

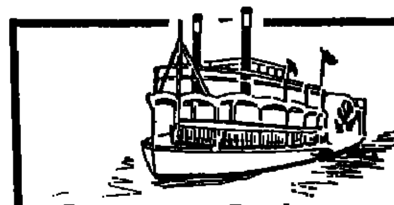
July 31-August 3, 1984 Workshop on Fission Track Dating, Troy, N.Y. Sponsors, General Electric Research and Development Laboratory, State University of New York at Albany, and Rensselaer Polytechnic Institute. (Donald S. Miller, Department of Geology, Rensselaer Polytechnic Institute, Troy, N.Y. 12181.)

Changes

March 11–16, 1984 American Congress on Surveying and Mapping, now American Society of Photogrammetry and American Congress on Surveying and Mapping Joint Annual Convention, Washington, D.C. Also, new contact: Jack Foreman, 5709 Annamarie Court, Derwood, MD 20855; telephone: 202-634-7324.)

March 10–15, 1985 American Congress on Surveying and Mapping, now American Congress on Surveying and Mapping and American Society of Photogrammetry Joint Annual Convention, Washington, D.C. Also, new contact: Jack Foreman, 5709 Annamarie Court, Derwood, MD 20855; telephone: 202-634-7324.)

March 16–21, 1986 American Congress on Surveying and Mapping, now American Society of Photogrammetry and American Congress on Surveying and Mapping Joint Annual Convention, Washington, D.C. Also, new contact: Jack Foreman, 5709 Annamarie Court, Derwood, MD 20855; telephone: 202-634-7324.)



Ocean Sciences Meeting
Abstract Deadline: October 19, 1983
New Orleans, Louisiana
Jan. 23–27, 1984

Call for Papers

Abstracts must be received at AGU by October 19, 1983. Late abstracts (1) may be summarily rejected by program chairman or (2) if accepted, will be charged a $25 late fee in addition to the regular publication charge and may not be published in advance of the meeting.

The 1984 Ocean Sciences Meeting of the American Geophysical Union (AGU) will be held January 23–27, 1984, in New Orleans, La. Housing and registration information will be published in *Eos* and will be mailed to anyone requesting information on the meeting. Cosponsoring societies are the American Society of Limnology and Oceanography (ASLO); the Acoustical Society of America (ASA); the American Meteorological Society (AMS); the Marine Technology Society (MTS); and the Institute of Electrical and Electronics Engineers Oceanic Engineering Society (OES).

General Regulations

Abstracts may be rejected without consideration of their content if they are not received by the deadline or are not in the proper format. Abstracts may also be rejected if they contain material outside the scope of the meeting or if they contain material already published or presented elsewhere. **Only one contributed paper by the same first author will be considered for presentation:** additional papers (unless invited) will be automatically rejected.

Abstracts not authored by a member of AGU or of one of the cosponsoring societies must be sponsored by such a member; this includes invited abstracts.

There is a publication charge of $40 ($30 if prepaid) for each abstract. The publication charge is only $20 ($15 if prepaid) if the first author is a student. Both invited and contributed papers are subject to the publication charge. Prepayment of the publication charge saves money. Send a check for $30 ($15 for students) with your abstract. Abstracts must be received at AGU by October 19 to avoid an additional $25 charge.

For actual size, see *Eos*, p. 135, April 5, 1983.

Sample Abstract

11.8 cm

Technique for the Preparation of Abstracts

F. R. S. T. AUTHOR (School of Oceanography, Hydro University, Watertown, Mass. 02172)
S. C. N. D. AUTHOR (USGS, Woods Hole, Mass. 02543)
(Sponsor: I. C. Alvin)

Follow this example in typing the abstract. The printing plates will be prepared by photographing the abstracts exactly as they are received, except that abstracts exceeding the maximum length (18 cm) or width (11.8 cm) will be cut to conform.

Use a good typewriter with a ribbon in good condition. A carbon ribbon gives the best results. Please use type of about this size. Use 12 pitch. There will be a reduction of 50% for the printed abstract volume.

Follow these guidelines:

(1) Type title in capital and lower case letters except where all capitals are standard. Underscore entire title.
(2) Leave one line blank after title.
(3) Type names of authors in all capital letters, with affiliation and address in capital and lower case letters. Do not leave blank lines between authors.
(4) Underscore the name of author who will present paper.
(5) If no author is a member of a cosponsor society, type sponsor's name in capital and lower case letters.
(6) Leave one blank line after author block.
(7) Neatly drawn in symbols or Greek letters are acceptable. Use India ink.
(8) Use SI units.

18 cm

NOTE: There are no special forms distributed for typing abstracts. You may trace this form in nonreproducible ink. Please leave at least 1 cm between top edge of paper and abstract title. Type abstract as close as possible to left edge of paper.

Submittal Information
(See explanation)

1. Ocean Sciences Meeting
2. AGU, ASLO, MTS, OES, AMS or ASA or XXXX (sponsor's name)
3. (a). Corresponding address: S.C.N.D. Author, MS 123, USGS, Woods Hole, MA 02543
   (b). Telephone number 617-548-1234
4. A (Atmospheric Science)
5. Special Session: Deep-Sea Drilling (or none)
6. P (Poster)
7. 10% at AGU Spring Meeting
8. (a). Hydro Univ: Accounting Dept., Admin. Bldg., Watertown, MA 02172
   (b). P.O. 25684739
   (c). Student rate applicable
   (d). If prepaid enter amount enclosed. (P.O.'s requiring invoicing are not eligible for discount rate)
9. C (Contributed)

Abstract Deadline: October 19, 1983
Mail original and two copies to
Ocean Sciences Meeting
American Geophysical Union
2000 Florida Avenue, N. W.
Washington, D.C. 20009

(cont. on p. 448)